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NASA TECH BRIEF

Ames Research Center

Electrolysis Cell Functions as Water Vapor Dehumidifier and Oxygen Generator

A special electrolysis cell generates oxygen by acting on the water vapor in recirculated air. The water vapor is absorbed in a hygroscopic electrolyte, and oxygen generated by the electrolysis of the absorbed water at the anode is added simultaneously to the air stream. Hydrogen generated at the cathode is collected in a suitable vessel for storage or for direct use in a separate hydrogenation system.

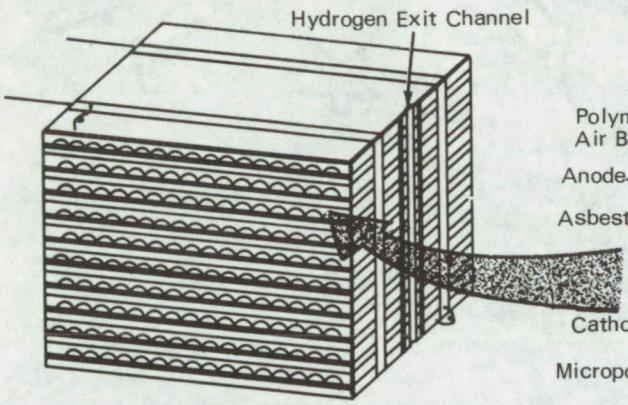

Figure 1. Battery of 10 Cells Connected in Series Electrically

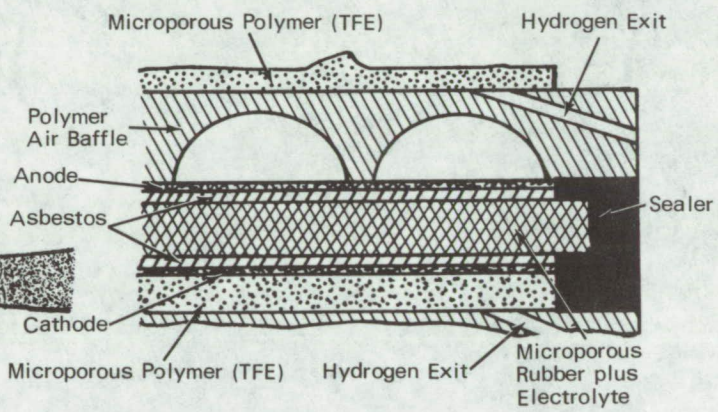

Figure 2. Electrolysis Cell, Cross Section

Applications for adaptations of the water vapor electrolysis cell include on-board aircraft oxygen systems, portable oxygen generators for hospitals and rescue squads, oxygen concentration requirements, and commercial air conditioning and dehumidifying systems.

A laboratory model of a battery of 10 identical electrolysis cells stacked one above the other and connected in series electrically is shown in Figure 1. The humid air stream enters the cell compartments at the back of the battery, and the oxygen-enriched air stream emerges from the flutes in the polymer air baffles, represented at the front of the battery.

The orientation of an air baffle in a single intermediate electrolysis cell is shown in the schematic cross section of Figure 2. In contact with the lower fluted surface of the air baffle is a platinized (platinum-black coated) platinum screen anode. Below this is a thin layer of asbestos in contact with a matrix of microporous rubber impregnated with an 85% aqueous solution of phosphoric acid, which serves as the hygroscopic electrolyte. Below this matrix is another thin layer of asbestos, a platinized platinum screen cathode, and a layer of microporous fluorocarbon polymer (TFE). The edges of the matrix assembly are sealed with a silicone elastomer. A small-diameter hole is drilled at an angle into one edge of the air baffle to provide an outlet for the hydrogen generated at the cathode. The microporous

(continued overleaf)

TFE prevents loss of electrolyte from the cathode side, but allows hydrogen gas to pass through the microporous channels at a relatively rapid rate. A membrane between the anode and cathode compartments prevents the mixing of the hydrogen and oxygen gases.

When the cells of the battery stack shown are in operation, a calculated dc potential difference is applied across the leads to the cell electrodes. The water absorbed from the air stream is electrolyzed by the electrolyte, and oxygen and hydrogen are generated at the anodes and cathodes, respectively. The oxygen enriches the effluent air stream and the hydrogen is collected separately.

Notes:

1. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   References:
   NASA-CR-771 (N67-29400), A Water-Vapor Electrolysis Cell with Phosphoric Acid Electrolyte

   NASA-CR-73170 (N68-14784), A Water-Vapor Electrolysis Cell with Phosphoric Acid Electrolyte
2. Technical questions may be directed to:
   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: B71-10231

Patent status:

No patent action is contemplated by NASA.

Source: J. E. Clifford of
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